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ABSTRACT

The United States Training and Employment Service General Aptitude Test Battery (GATB), first published in 1947, has been included in a continuing program of research to validate the tests against success in many different occupations. The GATB consists of 12 tests which measure nine aptitudes: General Learning Ability; Verbal Aptitude; Numerical Aptitude; Spatial Aptitude; Form Perception; Clerical Perception; Motor Coordination; Finger Dexterity; and Manual Dexterity. The aptitude scores are standard scores with 100 as the average for the general working population, and a standard deviation of 20. Occupational norms are established in terms of minimum qualifying scores for each of the significant aptitude measures which, when combined, predict job performance. Cutting scores are set only for those aptitudes which aid in predicting the performance of the job duties of the experimental sample. The GATB norms described are appropriate only for jobs with content similar to that shown in the job description presented in this report. A description of the validation sample is included. (AG)

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U.S. Training and
Employment Service
Technical Report
S-107 R

Development of USTES

APTITUDE TEST BATTERY FOR

BRICKLAYER
(const.)
861.381

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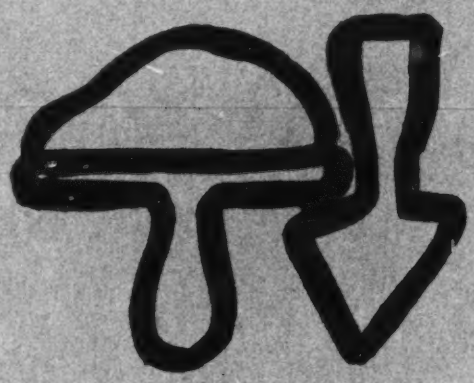

TM 001 540

Technical Report on Development of USTES Aptitude Test Battery

For . . . . . .

Bricklayer (const.) 861.381

S-107R

(Developed in Cooperation with the
Pennsylvania State Employment Service)

U.S. Department of Labor
Manpower Administration

June 1970

FOREWORD

The United States Training and Employment Service General Aptitude Test Battery (GATB) was first published in 1947. Since that time the GATB has been included in a continuing program of research to validate the tests against success in many different occupations. Because of its extensive research base the GATB has come to be recognized as the best validated multiple aptitude test battery in existence for use in vocational guidance.

The GATB consists of 12 tests which measure 9 aptitudes: General Learning Ability, Verbal Aptitude, Numerical Aptitude, Spatial Aptitude, Form Perception, Clerical Perception, Motor Coordination, Finger Dexterity, and Manual Dexterity. The aptitude scores are standard scores with 100 as the average for the general working population, with a standard deviation of 20.

Occupational norms are established in terms of minimum qualifying scores for each of the significant aptitude measures which, in combination, predict job performance. For any given occupation, cutting scores are set only for those aptitudes which contribute to the prediction of performance of the job duties of the experimental sample. It is important to recognize that another job might have the same title but the job content might not be similar. The GATB norms described in this report are appropriate for use only for jobs with content similar to that shown in the job description included in this report.

GATB Study # 854

Development of USTES Aptitude Test Battery

For

Bricklayer (const.) 861.381-010

S-107R

This report describes research undertaken for the purpose of developing General Aptitude Test Battery (GATB) norms for the occupation of Bricklayer (const.) 861.381-010. The following norms were established:

GATB Aptitudes	Minimum Acceptable GATB Scores
N - Numerical Aptitude	85
S - Spatial Aptitude	90
P - Form Perception	90
K - Motor Coordination	85

Research Summary

Sample:

50 male senior students enrolled in bricklaying in Pennsylvania. This study was conducted prior to the requirement of providing minority group information. Therefore, minority group status is unknown.

Criterion:

Average final grade in trade theory and trade practice.

Design:

Longitudinal (the sample was tested in May and November of 1952; criterion data were final grades for the year 1952-1953).

Minimum aptitude requirements were determined on the basis of a job analysis and statistical analyses of aptitude mean scores, aptitude-criterion correlations and selective efficiencies.

Predictive Validity:

Phi Coefficient = .52 ($P/2 < .0005$)

Effectiveness of Norms:

Only 68% of the nontest-selected students used for this study were good students ; if the students had been test-selected with the above norms, 82% would have been good students. Thirty-two percent of the nontest-selected students used for this study were poor students; if the students

had been test-selected with the above norms, only 18% would have been poor students. The effectiveness of the norms is shown graphically in Table 1:

TABLE I

Effectiveness of Norms

	Without Tests	With Tests
Good Students	68%	82%
Poor Students	32%	18%

SAMPLE DESCRIPTION

Size:

N = 50

Occupational Status:

Students

Work Setting:

Students were enrolled at the Williamson Free School of Mechanical Trades, Delaware County, Pennsylvania

Employer Selection Requirements:

Education: None required.

Previous Experience: None required.

Tests: Standard mental and mechanical aptitude tests.

Other: Physical examination.

Principal Activities:

The job duties for each worker are comparable to those shown in the job description in the Appendix.

Minimum Experience:

None required.

TABLE 2

Means, Standard Deviations (SD), Ranges and Pearson Product-Moment Correlations with the Criterion (r) for Age and Education

	Mean	SD	Range	r
Age (years)	18.4	1.3	16-21	.447*
Education (years)	11.1	1.2	9-16	.238

*Significant at the .01 level

EXPERIMENTAL TEST BATTERY

All 12 tests of the GATB, B-1001 were administered in May and November of 1952. The B-1001 scores have been converted to equivalent B-1002 scores.

CRITERION

The criterion data consisted of final grades in trade theory and final grades in trade practice. A Pearson product-moment correlation of .82 was obtained between the two measures. Although the two criteria were designed to measure different aspects of performance, the high correlation (.82) indicates that they measure substantially the same thing. Therefore, the average of final grades in trade theory and trade practice was used as the criterion for this study. The distribution of the averaged grades ranges from 84 to 96 with a mean of 90.5 and a standard deviation of 2.8.

Criterion Dichotomy:

The criterion distribution was dichotomized into low and high groups by placing 32% of the sample in the low group to correspond with the percentage of workers considered unsatisfactory or marginal. Workers in the high criterion group were designated as "good workers" and those in the low group as "poor workers." The criterion critical score is 90.

APTITUDES CONSIDERED FOR INCLUSION IN THE NORMS

Aptitudes were selected for tryout in the norms on the basis of a qualitative analysis of job duties involved and a statistical analysis of test and criterion data. Aptitudes S and P which do not have high correlations with the criterion, were considered for inclusion in the norms because the qualitative analysis indicated that the aptitudes might be important for the job duties and the sample had relatively high mean scores on these aptitudes. Tables 3, 4 and 5 show the results of the qualitative and statistical analyses.

TABLE 3

Qualitative Analysis
(Based on the job analysis, the aptitudes indicated appear to be important to the work performance)

Aptitudes	Rationale
G - General Learning Ability	Required in learning and understanding the fundamentals of the courses in bricklaying and in reading and understanding blueprints, work sketches, verbal instructions and specifications.
N - Numerical Aptitude	Required in those phases of the work involving general mathematics, such as taking measurements and checking layout work against blueprints, checking alinement of bricks, height and thickness of structure and measuring thickness of joints.
S - Spatial Aptitude	Required in reading and interpreting blueprints, in measuring and cutting bricks to special sizes.
P - Form Perception	Required in laying window sill bricks at proper angles, pressing brick into mortar to aline with uniform thickness of mortar and in shaping mortar with tool to specified form.
F - Finger Dexterity	Required in handling equipment and tools.
M - Manual Dexterity	Required in handling equipment and tools, in placing and stacking material, in erecting scaffold, in mixing mortar, in spreading mortar and placing type of building unit used, in cutting bricks to special sizes with edge of trowel and in embedding iron rods in mortar.

Means, Standard Deviations (SD), Ranges and Pearson Product-Moment Correlations with the Criterion (r) for the Aptitudes of the GATB; N = 50

	Mean	SD	Range	r
G - General Learning Ability	106.6	10.9	77-127	.381**
V - Verbal Aptitude	93.5	10.5	69-118	.513**
N - Numerical Aptitude	107.1	14.1	73-133	.309*
S - Spatial Aptitude	114.5	14.3	74-146	.061
P - Form Perception	113.5	11.7	89-151	.255
Q - Clerical Perception	97.1	11.6	75-129	.376**
K - Motor Coordination	101.8	13.7	70-130	.339*
F - Finger Dexterity	99.4	21.2	40-153	.153
M - Manual Dexterity	95.7	22.9	3-144	.217

*Significant at the .05 level
**Significant at the .01 level

TABLE 5

Summary of Qualitative and Quantitative Data

Type of Evidence	Aptitudes								
	G	V	N	S	P	Q	K	F	M
Job Analysis Data									
Important	X		X	X	X			X	
Irrelevant									
Relatively High Mean			X	X	X				
Relatively Low Standard Deviation	X	X			X	X			
Significant Correlation with Criterion	X	X	X			X	X		
Aptitudes to be Considered for Trial Norms	G	V	N	S	P	Q	K		

DERIVATION AND VALIDITY OF NORMS

Final norms were derived on the basis of the degree to which trial norms consisting of various combinations of aptitudes G, V, N, S, P, Q and K at trial cutting scores were able to differentiate between the 68% of the sample considered to be good workers and the 32% of the sample considered to be poor workers. Trial cutting scores at five-point intervals approximately one standard deviation below the mean are tried because this will eliminate about one-third of the sample with three-aptitude norms. For four-aptitude trial norms, cutting scores of slightly less than one standard deviation below the mean will eliminate about one-third of the sample; for two-aptitude trial norms, minimum cutting scores of slightly more than one standard deviation below the mean will eliminate about one-third of the sample. The phi coefficient was used as a basis for comparing trial norms. Norms of N-85, S-90, P-90, and K-85 provided optimum differentiation for the occupation of Bricklayer (const.) 861.381-010. The validity of these norms is shown in Table 6 and is indicated by a phi coefficient of .53 (statistically significant at the .0005 level).

TABLE 6

Concurrent Validity of Test Norms
N-85, S-90, P-90, and K-85

	Nonqualifying Test Scores	Qualifying Test Scores	Total
Good Students	2	32	34
Poor Students	9	7	16
Total	11	39	50

Phi coefficient = .52 Chi square (X^2_y) = 13.3

Significance Level = P/2 < .0005

DETERMINATION OF OCCUPATIONAL APTITUDE PATTERN

The data for this study met the requirements for incorporating the occupation studied into OAP-38 which is shown in the 1970 edition of Section II of the Manual for the General Aptitude Test Battery. A phi coefficient of .29 is obtained with the OAP-38 norms of N-80, S-85, K-80.

FACT SHEET

Job Title: Bricklayer (const.) 861.381-010

Job Summary: Lays brick, terra cotta, hollow tile, and similar building blocks (except stone) to construct walls, partitions, arches, fireplaces, chimneys, smokestacks, and other structures.

Work Performed: Studies blueprints, work sketches, or specifications to determine lay-out of structure. Spreads soft bed (layer) of mortar that serves as base and binder for block, using trowel. Applies mortar to end of block and positions block in mortar bed. Taps block with trowel to level, aline, and embed it in mortar, allowing specified thickness of joint. Removes excess mortar from face of block, using trowel. Finishes mortar between brick with pointing tool or trowel. Breaks brick to fit spaces too small for whole brick, using trowel, brick hammer, or brick cutter. Determines vertical and horizontal alinement of courses, using plumb bob, gageline (tightly stretched cord), and level. Fastens brick or terra cotta veneer to face of structures, with the wires embedded in mortar between bricks, or in anchor holes in veneer brick. Removes old mortar and blocks to repair structures.

Effectiveness of Norms: Only 68% of the nontest-selected students used for this study were good students; if the students had been test-selected with the S-107R norms, 82% would have been good students. Thirty-two percent of the nontest-selected students used for this study were poor students; if these students had been test-selected with the S-107R norms, only 18% would have been poor students.

Applicability of S-107R Norms: The aptitude test battery is applicable to jobs which include a majority of duties described above.

GPO 898.784

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